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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/602,915	06/25/2003	Kazuhiko Yamamoto	60188-606	1774

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EXAMINER

NADAV, ORI

ART UNIT PAPER NUMBER

2811

DATE MAILED: 08/09/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/602,915

Applicant(s)

YAMAMOTO, KAZUHIKO

Examiner

Ori Nadav

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 26 June 2006.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,3,4 and 21-36 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,3,4 and 21-36 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 1, 3-4 and 21-36 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The claimed limitation of "substantially directly contacting", as recited in claims 1, 21 and 35-36, are unclear as to whether the two elements are directly contacting or are not directly contacting.

The claimed limitation of a sidewall formed to cover the side faces of the gate electrode, as recited in claims 27 and 34, is unclear as to how a sidewall can cover the side faces of the gate electrode, since the side faces of the gate electrode are the sidewalls.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1, 21, 24, 26-27, 31, 33-36, as best understood, are rejected under 35 U.S.C. 103(a) as being unpatentable over Jeon (6,562,491) or Kaushik (6,448,192).

Kaushik teaches in figure 6 and related text a semiconductor device comprising a gate insulating film 50 having a multilayer structure including a zirconium oxide film.

Kaushik does not explicitly state that the gate insulating film 50 having a multilayer structure including a zirconium oxide film and a high dielectric constant film which is formed of an oxide of a metal other than zirconium and substantially directly contacting the zirconium oxide film, wherein the high dielectric constant film is a hafnium oxide film.

Kaushik teach that the gate insulating film 50 can have a multilayer structure including a zirconium oxide film and a high dielectric constant film which is formed of an oxide of a metal other than zirconium and substantially directly contacting the zirconium oxide film, wherein the high dielectric constant film is a hafnium oxide film (column 3, lines 40-42)

It would have been obvious to one having ordinary skill in the art at the time the invention was made to use a gate insulating film having a multilayer structure including a zirconium oxide film and a high dielectric constant film which is formed of an oxide of a metal other than zirconium and substantially directly contacting the zirconium oxide film, wherein the high dielectric constant film is a hafnium oxide film in Kaushik's device in order to improve the gate dielectric characteristics of the device.

Jeon teaches a semiconductor device comprising a gate insulating film having a structure including a zirconium oxide film (see claims 6 and 14).

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Jeon does not explicitly state that the gate insulating film having a multilayer structure including a zirconium oxide film and a high dielectric constant film which is formed of an oxide of a metal other than zirconium and substantially directly contacting the zirconium oxide film, wherein the high dielectric constant film is a hafnium oxide film.

Jeon teach in claims 6 and 14 a semiconductor device comprising a gate insulating film which can have a multilayer structure including a zirconium oxide film and a high dielectric constant film which is formed of an oxide of a metal other than zirconium and substantially directly contacting the zirconium oxide film, wherein the high dielectric constant film is a hafnium oxide film (column 15, lines 50-56 and column 16, lines 37-49).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to use a gate insulating film having a multilayer structure including a zirconium oxide film and a high dielectric constant film which is formed of an oxide of a metal other than zirconium and substantially directly contacting the zirconium oxide film, wherein the high dielectric constant film is a hafnium oxide film in Jeon's device in order to improve the gate dielectric characteristics of the device.

Regarding claims 24, 27, 31 and 34, prior art teaches comprising a gate electrode on the gate insulating film and a sidewall formed to cover the side faces of the gate electrode.

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Regarding claims 26, 33 and 35-36, it would have been obvious to one having ordinary skill in the art at the time the invention was made to use a gate electrode of thickness between 30-100 nm, wherein the high dielectric constant film substantially directly contacts the top surface of the zirconium oxide film in prior art in order to improve the device characteristics.

Claims 3 and 28, as best understood, are rejected under 35 U.S.C. 103(a) as being unpatentable over Jeon (6,562,491) or Kaushik (6,448,192) in view of Yang et al. (6,451,647).

Jeon and Kaushik teach substantially the entire claimed structure, as applied to claims 1 and 21 above, except a high dielectric constant film contains nitrogen. Yang et al. teach the high dielectric constant film (hafnium silicate layer) contains nitrogen (column 5, lines 19-23). It would have been obvious to one having ordinary skill in the art at the time the invention was made to incorporate the teaching of Yang et al. into prior art's device in order to provide better protection to the gate by increasing the dielectric constant of the high dielectric constant film.

Claim 4, as best understood, is rejected under 35 U.S.C. 103(a) as being unpatentable over Jeon (6,562,491) or Kaushik (6,448,192) in view of Lee et al. (6,844,604).

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Jeon and Kaushik teach substantially the entire claimed structure, as applied to claim 1 above, except a gate insulating film includes a zirconium silicate film 12 formed under the zirconium oxide film.

Lee et al. teach a gate insulating film includes a zirconium silicate film 12 formed under the zirconium oxide film. It would have been obvious to one having ordinary skill in the art at the time the invention was made to use a gate insulating film includes a zirconium silicate film 12 formed under the zirconium oxide film in prior art's device in order to improve the device characteristics.

Claims 22-23 and 29-30, as best understood, are rejected under 35 U.S.C. 103(a) as being unpatentable over Jeon (6,562,491) or Kaushik (6,448,192) in view of Chidambarao et al. (6,709,926).

Jeon and Kaushik teach substantially the entire claimed structure, as applied to claims 1 and 21 above, except a gate insulating film includes a silicon nitride film formed under the zirconium oxide. Chidambarao et al. teach a gate insulating film includes a silicon nitride film, a zirconium oxide and a hafnium oxide film (column 3, lines 31-45). It would have been obvious to one having ordinary skill in the art at the time the invention was made to use a gate insulating film includes a silicon nitride film formed under the zirconium oxide in prior art's device in order to provide better protection to the gate by increasing the dielectric constant of the high dielectric constant film.

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Claims 25 and 32, as best understood, are rejected under 35 U.S.C. 103(a) as being unpatentable over Jeon (6,562,491) or Kaushik (6,448,192) in view of Price et al. (4,605,947).

Jeon and Kaushik teach substantially the entire claimed structure, as applied to claims 1 and 21 above, except a gate electrode is a titanium nitride. Price et al. teach a gate electrode 70 is a titanium nitride. It would have been obvious to one having ordinary skill in the art at the time the invention was made to use a gate electrode being a titanium nitride in prior art's device in order to improve the device characteristics by a well known gate material.

Response to Arguments

Applicant's arguments with respect to claims 1, 3, 4 and 21-36 have been considered but are moot in view of the new ground(s) of rejection.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ori Nadav whose telephone number is 571-272-1660. The examiner can normally be reached between the hours of 7 AM to 4 PM (Eastern Standard Time) Monday through Friday.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie Lee can be reached on 571-272-1732. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

A handwritten signature in black ink, appearing to read 'ORI NADAV', is positioned above the printed name.

O.N.
8/4/06

ORI NADAV
PRIMARY EXAMINER
TECHNOLOGY CENTER 2800